Prevalence of Active Trachoma and Associated Factors among Elementary School Students in Butajira Town, Ethiopia

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Abstract

Purpose: To determine the prevalence of active trachoma among elementary school students in Butajira town, Ethiopia. Additionally, the study aimed to identify the factors related to its occurrence and compare the findings with previous studies conducted in the same area.

Methods: A cross-sectional study was conducted in Butajira town's elementary schools in March **2023.** Data on the sociodemographic and health characteristics of students and their respective schools was collected using a structured questionnaire. An experienced nurse, certified in trachoma grading according to the World Health Organization's system, performed eye examinations on the students. The aim of the study was to assess potential associations between hygiene factors (such as ocular discharge, nasal discharge…etc) and school factors (including compound fencing status, school water source….etc). Statistical analyses were conducted using the chi-square test to determine the significance of associations between variables. A p-value below 0.05 was considered statistically significant.

Results: A total of 606 students participated in this study, with 376 attending public elementary schools and 230 attending private elementary schools. Among these students, 55.7% were females and 44.2% were males. The mean age of the participants was 10.8 ± 2.5, ranging from 6 years to 18 years. Out of the 606 students, 23 (3.8%) had active trachoma. Statistically significant associations with active trachoma were observed in the following variables: cleanliness of finger (χ^2 = 5.3,OR=1.052**,** 95% CI(1.00,1.107), p = 0.021), presence of cattle in school compound (χ^2 = 6.3,OR= 2.916, 95% CI(1.312,6.078), p = 0.012), face washing (χ^2 = 8.891,OR=3.305, 95%CI(1.514, 7.215), p < 0.003), number of students per bench (χ^2 = 21.625,OR=0.065, 95%CI(0.016, 0.274) p =0.001), school type (χ^2 = 22.508, OR=0.939, 95%CI(0.915,0.963), p =0.0001), open field defecation (χ^2 = 15.4,OR=6.982, 95%CI(2.097,23.250), p =0.001), proper latrine usage (χ^2 = 6.020, OR=0.485, 95%CI(0.273,0.864), p =0.014), presence of fly on face (χ^2 = 18.5,OR=7.38, 95%CI(3.177,18.844), p = 0.001), nasal discharge (χ^2 = 43.7, OR=11.294, 95%CI(4.768,26.752), p =0.0001), and ocular discharge (χ^2 = 254.2, OR=60.75, 95%CI(26.049,141.720), p = 0.0000).

Conclusion: The study discovered that the prevalence of active trachoma is below 5%, which meets the goal of the trachoma eradication plan. Factors commonly known to be associated with the transmission of trachoma were strongly linked in this study as well. Additionally, factors such as school type, number of students per school bench, and the presence of cattle in the school compound were also strongly associated with prevalence of active trachoma.

Key words: Active trachoma, elementary schools, associated factors, Butajira town

INTRODUCTION

Trachoma, the leading infectious cause of blindness globally, is a disease that affects the eye. Its primary cause is a bacterium known as chlamydia trachomatis, which lives within cells. Transmission occurs through direct or indirect contact with the ocular and nasal secretions of infected individuals, with flies also capable of carrying the bacteria. Young children, especially those in preschool, serve as the main reservoir for this infection. Studies indicate that over 150 lifetime infections are necessary for an individual to develop the severe complications that can lead to blindness. These repeated infections cause significant scarring of the tarsal conjunctiva, resulting in the inward turning of the eyelids. Consequently, corneal opacity occurs, leading to irreversible blindness. (1)

The eradication of trachoma as a public health issue is defined as follows**:** (i) It is considered eliminated when the prevalence of trachomatous trichiasis in adults aged 15 years or older, which has not been reported to the health system, is less than 0.2% (<1 case per 1000 people). (ii) Additionally, the prevalence of trachomatous inflammation—follicular in children aged 1-9 years is less than 5% and this level is sustained for at least two years without the need for continuous antibiotic mass treatment in previously affected districts. (iii) Finally, there must be a system in place that can identify and manage new trachomatous trichiasis cases, using defined strategies, and there must be sufficient financial resources to implement these strategies effectively.(1)

In Ethiopia, the overall number of people requiring the surgery, facial cleanliness, and environmental improvement components of the SAFE strategy decreased from 67.2 million in June 2021 to 64.6 million in June **2022.** Despite advancements, trachoma still persists as a public health issue in most WHO countries, leading to the postponement of the target year for global elimination from 2020 to **2030.** However, the initiative continues to be referred to as the "WHO Alliance for GET2020" to emphasize the urgency in addressing this overdue elimination of trachoma. (3)

The prevalence of trachoma has been extensively studied in various regions of Ethiopia, with a strong focus on community-based research. However, there have been few studies conducted specifically in school settings. One notable example is the study conducted by Yoseph Worku and Samson Bayu in 1999, which found that the prevalence of active trachoma among school children in Butajira town was 33% (4). Another study conducted in a similar geographic location, about 215km away from Butajira town in the Kembata Tebaro zone, by Getahun A. et al in 2013, revealed a prevalence of 6.3% among elementary school children (5).This current study aims to assess the current prevalence of active trachoma in elementary schools within Butajira town. It is important to note that no previous research has evaluated school-related factors associated with trachoma, and our study aims to address this gap in knowledge.

Methods

Study design, area and population

The cross-sectional study was conducted in Butajira town, which is located in the Gurage zone of Ethiopia, approximately 130km south of Addis Ababa. The town covers an area of 9km2 and has an altitude of 2,131m above sea level. According to the 2007 national census, it was projected that the population of the town was approximately 89,824. There are thirteen elementary schools in Butajira town, of which eight are private and five are governmental. The study focused on elementary school students in Butajira town during the study period of March 2023.

Study variables

The prevalence of active trachoma served as the dependent variable in the study. On the other hand, the independent variables encompassed various socio-demographic characteristics of the students, occurrence of ocular and nasal discharge, presence of flies on the face, factors related to hygiene (such as face washing and clean cloth, defined as the absence of any visible dirt on the student's uniform or clothing, as well as clean fingers, defined as the absence of easily visible dirt), conditions within the school environment, and the availability of sanitation facilities.

Sample size determination

To determine the sample size, a previous study conducted in 2013 by Getahun A. et al which found the prevalence of active trachoma to be 6.3% elementary schools of southern Ethiopia. The total number of elementary schools in Butajira town was thirteen, with eight being private and five public schools. The total number of elementary students in Butajira town was 13,352, with 3,963 in private schools and 9,389 in public schools. Using an expected prevalence of active trachoma of 6.3%, a precision that would produce a 95% confidence interval with a margin of error of 2.5%, and accounting for a design effect of 1.5 and a 10% increase for non-response, the required sample size was calculated using the single population proportion formula.it was determined to be 583.

Sampling procedure

Multistage sampling procedure was conducted in Butajira town among elementary schools. First, the schools in the town were divided into two clusters: private schools and public schools. 6 private schools and 5 public schools were selected randomly from each cluster. From each of the selected schools, one section was randomly chosen from within sections one to eight. Next, within each chosen section, a certain number of students were recruited. Specifically, between 5 to 20 students sitting in the middle of the class were selected. To be included in the study, students had to meet certain criteria. They needed to have been attending the selected schools for a minimum of 6 months. Students who were uncooperative or absent on the day of the interview were not included in the study.

Data collection

The clinical examination was conducted by a qualified field trachoma grader using magnifying binocular lenses and penlight torches. The simplified trachoma grading scheme developed by WHO for field work was used (6). In this guideline trachoma clinical signs were classified into 5 grades which are:
1. Trachomatous inflammation - Follicular (TF) which is defined as having five or more follicles greater than 0.5mm in the upper tarsal conjunctiva 2. Trachomatous inflammation – Intense (TI) which is defined as intense inflammation to the extent of obscuring more than half of the upper tarsal conjunctival vessels 3. Trachomatous conjunctival Scaring (TS) which is defined as presence of easily identifiable upper tarsal conjunctival scaring 4. Trachomatous Trichiasis (TT) which is defined as at least one eye lash turned inwards rubbing the eye ball in the upper eyelid 5. Corneal opacity (CO) which is defined as presence of easily visible corneal opacity extending to the pupil. Each student was examined by turning out both upper lid. After examining each student examiner cleaned his hand using alcohol sanitizer before examining the next student. The result of the examination was documented for each student on prepared questioner by accompanying investigating ophthalmology resident. Children with active trachoma were prescribed azithromycin and given a letter of notice for their family members to be evaluated at the nearest eye care facility.
Each students hygiene related factors such as cleanliness of their clothes or uniform, cleanliness of their hands, nasal discharge, ocular discharge ,presence of flies on face of student and face washing habits were observed and interviewed by investigating resident and was filled to structured questioner for each participating student. After observing and interviewing participating students, their school compound was evaluated for source of water, fencing status of the schools, presence or absence of cattle in the compound, open field defecation, availability of functional latrine and their cleanliness, number of students per class and per bench were observed and filled to prepared structured questioner by investigating resident.

Ethical clearance

Written ethical clearance was obtained from review board of the Department of Ophthalmology, Butajira town Health Office and Butajira town education office. The purpose of the study was explained to each selected school directors and verbal consent was obtained.

Statistical analysis

Data was checked for completeness and cleaned, coded and entered to SPSS version 26
Descriptive frequency was determined for the study variables
Chi-square test, multivariate binary logistic regression analysis was done
P-value of less than 0.05 were used to define level of statistical significance

Results

There were a total of 606 students who were included in the study. Out of whom there were 338 females (55.7%) and 268 males (44.2%). The majority of the study participants, accounting for 428 students (70.6%), were in the age group of 6-12 years old (Table 1). Regarding hygiene, approximately 474 students (78.8%) had clean fingers, 549 students (90.5%) had clean cloth, 27 students (4.5%) had ocular discharge, and 102 students (16.8%) had nasal discharge. Regarding face hygiene, 602 children (99.3%) washed their face at least once per day, and 573 students (94.4%) used soap to wash their face. During the interviews, flies were observed on the faces of 21 students (3.5%). (Table 2 & 3)

In terms of school type, the distribution of students was as follows: 376 students (62%) attended public elementary schools, while 230 students (38%) attended private elementary schools. Public schools had an average of approximately 60 students per class, with a deviation of 11, while private schools had an average of around 53 students per class, also with a deviation of 11**.** When considering both types of schools combined, the overall average number of students was approximately 57.5, with a deviation of 10**.** Regarding seating arrangements, private schools had an average of two students per bench, while public schools had an average of three students per bench. This resulted in an overall average of 2.6 students per bench across all schools. With respect to school infrastructure, all selected elementary schools had fenced compounds, except for one public school. Additionally, all schools had functional latrines, although 6 of the public schools were found to be unclean. Both public and private schools had a separate dry waste disposal system. Regarding water sources, 10 schools (90.9%) used either a pipe or leaky tin as their water source, except for one public school which did not have any water source at all. In terms of additional observations, cattle were found in the compounds of 3 schools, all of which were public schools. Open field defecation in school compounds was noted in 5 schools, all of which were also public schools. The risk factors and prevalence of trachoma were compared between public and private schools. (Chart 1)

Distribution of trachoma grade among Elementary school students

Among the 606 students only 28 students found to have some sign of trachoma. It was mainly seen in the age range of 6 to 12 year old students. There was no case of trachomatous corneal opacity among participating students. The most common presenting WHO trachoma grade among these students was trachomatous inflammation – Intense (TI) accounting for 64 %.(Table 4)

Gender and age distribution of active trachoma among Elementary school students of Butajira town

There were 23 students who were found to have active trachoma making the overall prevalence of active trachoma 3.8%. Among these 9 were male and the remaining 14 were female students making male to female ratio of 1: 1.5. Majority of the students having active trachoma were in the age range of 6-12 accounting for 87% of the active trachoma cases. (Table 5)

Relationship of trachoma with risk factors:

The prevalence of active trachoma in females was 14 (60.8%), while in males it was 9 (39.2%), but this difference did not reach statistical significance. However, a strong statistically significant association was identified through bivariate analysis in the following variables:

cleanliness of finger (χ^2 = 5.3,OR=1.052**,** 95% CI(1.00,1.107), p = 0.021), presence of cattle in school compound (χ^2 = 6.3,OR= 2.916, 95% CI(1.312,6.078), p = 0.012), face washing (χ^2 = 8.891,OR=3.305, 95%CI(1.514, 7.215), p < 0.003), number of students per bench (χ^2 = 21.625,OR=0.065, 95%CI(0.016, 0.274) p =0.001), school type (χ^2 = 22.508, OR=0.939, 95%CI(0.915,0.963), p =0.0001), open field defecation (χ^2 = 15.4,OR=6.982, 95%CI(2.097,23.250), p =0.001), proper latrine usage (χ^2 = 6.020, OR=0.485, 95%CI(0.273,0.864), p =0.014), presence of fly on face (χ^2 = 18.5,OR=7.38, 95%CI(3.177,18.844), p = 0.001), nasal discharge (χ^2 = 43.7, OR=11.294, 95%CI(4.768,26.752), p =0.0001), and ocular discharge (χ^2 = 254.2, OR=60.75, 95%CI(26.049,141.720), p = 0.0000). However, in multivariate binary logistic regression only ocular discharge was found to be statistical significant (p-value = 0.000, exp (b) = 84.585, 95 % CI (20.856,354.018)). (Table 6)

Discussion

A recent systematic review and meta-analysis of community-based studies conducted until December 2018 revealed that the overall prevalence of active trachoma in Ethiopia was 26.9%. The highest prevalence was observed in the Southern Nations, Nationalities, and Peoples Region, with a rate of 35.8%. (18). To see the current situation at Butajira town specifically at elementary schools of the town we conducted cross-sectional study focusing on prevalence of active trachoma and its associated factors.

This study which was conducted in Butajira town determined that the prevalence of active trachoma among elementary school students was 3.8%. This finding aligns with the target set by the World Health Organization (WHO) to eradicate trachoma.

Compared to other studies, the prevalence of active trachoma in Butajira town elementary schools is lower than several studies, including one conducted in Butajira Town in southern Ethiopia, 1999(33%) (4), Southern Ethiopia, 2013 (6.3%) (5), Amhara region among elementary school children, 2018 (10.3%) (7), another one in Dire Dewa city, 2019 (4.3%) (8), in Yello elementary school children in Lomea Woreda, Dawro Zone, 2015 (22.5%) (9), as well as study done in Dangla town in the Amhara region, 2012 (12%) (10), rural area of Tanzania, 1998(5.5%)(11) and in Yemen Sana'a city, 2018(9.1%) (12) and Yemen Bajjil district, 2020(10.93%)(13).

However, it is worth noting that the prevalence of active trachoma in Butajira town elementary schools is higher than some studies, such as one conducted in the Harari region of eastern Ethiopia, 2016 (1.3%) (14), a study done in Khartoum State, Sudan 2007(0.04%)(15), study done in the Bahawalpur district in Pakistan (2.9%), 2019(16), and a study done in the Marajo Archipelago in the Brazilian Amazon, 2016 (0.2%)(17).

The variability in these prevalence rates can be attributed primarily to the year of the studies, as many endemic countries, including Ethiopia, are implementing SAFE strategies to eliminate trachoma. Additionally, the geographic location of the studies may also contribute to the differences in the prevalence of active trachoma.

This study has found that prevalence of active trachoma has no association with gender. The findings indicated that, although there were more cases of active trachoma among females (60.8%) compared to males (39.2%), this difference was not statistically significant. This means that the observed disparity in the number of cases between genders could have occurred by chance and is not necessarily indicative of a true association. Interestingly, similar results were found in other studies conducted in different regions such as Butajira Town in southern Ethiopia,1999 (4), Amhara region in northwest Ethiopia,2018 (7), Dire Dawa in eastern Ethiopia,2019 (8), Loma Woreda in the Dawro zone of Ethiopia,2015 (9), in Sana'a City Yemen,2018 (12) and in Bajjil district of Al Hudaydah, Yemen 2020(13). These studies also reported no significant association between gender and the prevalence of active trachoma. Therefore, the collective evidence from these studies suggests that, at least in these specific regions, gender does not play a significant role in determining the prevalence of active trachoma.

Although this particular study found a higher occurrence of active trachoma in the age group of 6-12 (approximately 20, or 86.9%), the statistical significance was not strong, indicated by a p-value of 0.**056.** Multiple other studies conducted in various regions such as Butajira Town, Southern Ethiopia, 1999 (4), Southern Ethiopia, 2013(5), Loma Woreda, Dawro Zone Ethiopia, 2015 (9), Dangla Town, Amhara Regional State, Ethiopia,2012 (10), and Sana'a City Yemen 2018(12), Bajjil District Al Hudaydah, Yemen, 2020 (13) have shown a greater prevalence of active trachoma in the age group of 6-**9.** It is possible that the difference observed in this study is attributable to a smaller sample size and the majority of participants falling within the 6 to 12-year-old range, in contrast to the aforementioned studies.

This study found that there is a strong and statistically significant association between the prevalence of active trachoma and various factors such as ocular discharge, nasal discharge, presence of flies on the face of students, face washing, cleanliness of fingers, and open field defecation. However, upon further analysis (multivariate), it was determined that these associations became diluted and the strongest relationship or association was observed only with the presence of Ocular discharge. Similar studies conducted in Ethiopia (Northwest Amhara Region 2018, Dire Dewa, 2019, Loma Woreda, Dawro Zone, 2015) and Yemen (Sena'a City 2018, Bajjil District, Al Hudaydah, 2020) also showed statistically significant association with at least one of the mentioned factors in the bivariate analysis.(7,8,9,12, 13).

However, in multivariate binary logistic regression analysis we examined these variables to determine their relationship with the occurrence of active trachoma. Among those variables which had statistically significant association on bivariate analysis, only the presence of ocular discharge was found to be strongly associated with the occurrence of trachoma. Specifically, individuals who had ocular discharge had a significantly higher risk of experiencing active trachoma compared to those who did not have ocular discharge. The risk was estimated to be 84 times higher, as indicated by the exponential of the regression coefficient (exp(b) = 84.585). This finding was supported by a 95% confidence interval (CI) ranging from 20.856 to 354.018. Additionally, the p-value was determined to be statistically significant (p-value = 0.000), further strengthening the evidence for this association. On the other hand, the other variables we investigated did not show a significant association with the prevalence of active trachoma. Their p-values were found to be greater than 0.05, indicating a lack of statistical significance. Moreover, their confidence intervals included the value of 1, which suggests that these variables did not have a substantial effect on the occurrence of active trachoma. These findings demonstrate that among the variables we examined, only ocular discharge exhibited a strong and significant relationship with the occurrence of trachoma

This study assessed selected elementary schools by using a structured questionnaire to identify school factors associated with active trachoma. This particular aspect had not been investigated by previous studies to the knowledge of the authors. The findings revealed that active trachoma had a statistically significant correlation with the type of school (students in private schools were 0.9 times less likely to acquire trachoma), the number of students per bench, the presence of cattle in the school compound, the condition of school latrines, and open field defecation in the school compound. However, upon further analysis using multivariate techniques, none of these factors demonstrated a statistically significant association or relationship.

There were noticeable distinctions between private and public schools when it comes to certain factors. Private school students were observed to have neatly dressed attire and maintain good physical cleanliness. Additionally, private school compounds were generally well-maintained and create an inviting atmosphere with regards to cleanliness in various areas such as playgrounds, dining areas, and the fencing surrounding the school premises. Further research can delve into these differences and investigate whether they contribute to the prevention or occurrence of health issues, such as trachoma or other related concerns.

Conclusion

As compared to previous studies this study showed lower prevalence of active trachoma in school age children. It is also in the target range of towards in elimination of trachoma. This is encouraging result. Yet those identified risk factors still may contribute to recurrence of trachoma.

Recommendation

In order to further decrease the prevalence and effectively control the transmission of trachoma, federal, regional, and district health and educational authorities should collaborate to provide health education to students, improve the sanitary conditions of classrooms and school compounds by targeting these associated factors, and promptly identify students with trachoma and treat both them and their close contacts.

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Chart 1: Descriptive statistics comparing public and private elementary school students of Butajira town, Ethiopia, 2023

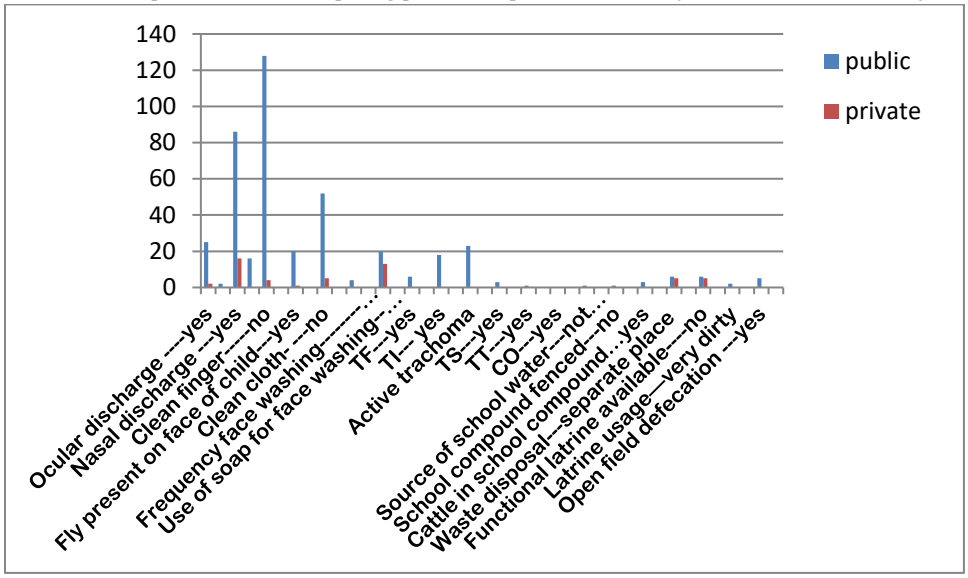

Table 1: The Age and Sex Distribution of elementary school students in Butajra, Ethiopia, 2023

Age (in years)	**Gender**		**Total**
	Male N (%)	Female N (%)	**N (%)**
6- 9	84 (42)	116(58)	200
10-12	113(49.6)	115(50.4)	228
13 – 18	71(39.9)	107(60.1)	178
Total	268	338	606

Table 2: Background characteristics of elementary school students of Butajira town, Ethiopia, 2023

Characteristics	No	%
Average No. of students per class	58	
Average No. of students per bench	3	
Ocular discharge		
Yes	27	4.5
No	579	95.5
Nasal discharge		
Yes	102	16.8
No	504	83.2
Clean fingers		
Yes	474	78.8
No	132	21.2
Presence of fly on student face		
Yes	21	3.5
No	585	96.5
Cleanliness of cloth		
Yes	549	90.5
No	57	9.5
Frequency of face washing		
No	4	0.7
Once	197	32.5
Twice or more	405	66.8
Use of soap during face washing		
Never	33	5.6
Sometimes	464	76.5
Once per week or more	109	17.9

Table 3: Background characteristics of selected elementary elementary schools of Butajira town, Ethiopia, 2023

Characteristics	No.	%
School water source		
Pipe or leaky tin	10	91
Protected well	0	0
Other	0	0
Not available	1	9
School compound fencing		
Yes	10	91
No	1	9
Presence of cattle in school compound		
1 up to 5	4	36
>5	0	0
None	7	64
Mechanism of Dry waste disposal		
Separate place	11	100
No separate place	0	0
Functional latrine availability		
Yes	11	100
No	0	0
Proper latrine usage		
Clean	5	45
Dirty	4	36
Very dirty	2	19
Open field defecation		
Few spots	5	45
Many	0	0
None	6	55

Table 4: Distribution of trachoma grades among Elementary school students, Butajira, Ethiopia, 2023

Characteristic		Trachoma grades											
		TF		TI		TS		TT		CO		Total	
		N	%	N	%	N	%	N	%	N	%	N	%
Age	6-9	**3**	50	**8**	44.4	**0**	0	**0**		**0**		**11**	39
	10-12	**2**	34	**8**	44.4	**2**	67	**0**		**0**		**12**	43
	13-18	**1**	16	**2**	11.1	**1**	33	**1**	100	**0**		**5**	18

Table 5: Gender and age distribution of active trachoma among Elementary school students of Butajira town, Ethiopia, 2023

prevalence of active trachoma (n = 23, 3.8%)								
Ages in years	6-9		10-12		13-18		Total	
Gender	N	%	N	%	N	%	N	%
Male	5	5.9	2	1.8	2	2.8	9	**3.4**
Female	5	4.3	8	6.9	1	0.9	14	**4.1**
Total	10	5	10	4.4	3	1.7	23	**3.8**

Table 6: Factors associated with active trachoma among elementary school students, Butajira town, Ethiopia.2023

Variables	Positive for active trachoma		OR	95 % CI	X^2	P
	N	%				
Crude rate	23	3.8				
No students per class					0.012	0.93
Number of students per bench			0.07	(0.016,0.2)	21.63	0.0001
School type						
Public n =376	23	6.1			22.5	0.0001
Ocular discharge						
Yes n=27	17	63	60.8	(26.05,141)	254.2	0.0001
Nasal discharge						
Yes n=102	16	15.7	11.3	(4.77,26.8)	43.7	0.0001
Clean finger						
No n =132	10	7.6	1.05	(1.00,1.11)	5.33	0.021
Presence of fly on the face of student						
Yes n = 21	5	24	7.74	(3.18,18.8)	18.5	0.0001
Clean cloth						
No n =549	3	5.3	0.76	(0.2, 2.5)	0.19	0.644
Frequency of face washing						
None n=4	0	0	3.30	(1.5,7.3)	8.88	0.003
Cattle in school compound						
1 -5 n=165	12	7.3	2.92	(1.3,6.1)	6.26	0.012
Proper latrine usage						
Clean n =270	2	0.7	.485	(0.27,0.86)	6.020	0.014
Dirty n =256	18	7				
Very dirty n = 80	3	3.8				
Open field defecation						
Few spots n = 296	20	6.8	6.98	(2.09,23.3)	15.39	0.001

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